

Vol. 5

No. 6

BULLETIN
OF THE
CHICAGO ACADEMY OF SCIENCES

MAMMALS OF THE GREAT SMOKY MOUNTAINS

BY

EDWIN V. KOMAREK
Cooperative Quail Study Association
AND

ROY KOMAREK
North Carolina Department of Conservation and Development



CHICAGO:
PUBLISHED BY THE ACADEMY,
1938

BULLETIN
OF THE
CHICAGO ACADEMY OF SCIENCES

Chicago, Illinois

Published by the Academy

MAMMALS OF THE GREAT SMOKY MOUNTAINS

BY

EDWIN V. KOMAREK

Cooperative Quail Study Association

AND

ROY KOMAREK

North Carolina Department of Conservation and Development

The interest of the writers in the mammals of the Great Smoky Mountains is largely an outgrowth of a preliminary study made in that region in the spring of 1931 by a field party from the Chicago Academy of Sciences and the University of Chicago. cursory collecting during this short visit revealed the presence of a new *Microtus* (Komarek, 1932) which led to further consideration of the area now comprising the Great Smoky Mountains National Park. In the spring of 1932 a detailed study of the mammals of this section of the southern Appalachians was undertaken and field work was continued at various times during the following two years in the interests of the Academy and with the cooperation of the U. S. National Park Service. Since the greater part of this investigation was carried on before the Park was developed this report establishes a basis for comparing the effects of the formation of the National Park upon the mammalian life of the region.

Preliminary field work was carried on from March 30 to April 25, 1931, by R. L. Boke, D. C. Lowrie, and Charles H. SeEVERS of the University of Chicago, Walter L. Necker and E. V. Komarek of the Academy. At this time activities were largely limited to the Greenbrier section of the Park and the vicinity of Smokemont, Swain County,

North Carolina. On February 15, 1932, headquarters were established at Greenbrier, Sevier County, Tennessee, and the study was continued by the writers, in various parts of the Park Area, through the following two years.

For cordial assistance and cooperation throughout the progress of this study we are grateful to Alfred M. Bailey, former Director, and Francis R. Dickinson, President of the Chicago Academy of Sciences; to Conrad L. Wirth and Dr. H. C. Bryant of the National Park Service; to Superintendent J. Ross Eakin, Assistant Chief Ranger Charles S. Dunn, and other members of the staff of the Great Smoky Mountains National Park; and to many residents of the Park Area, especially Fire Guards Ennis Ownby and William Ramsey, and Elbert Whaley, former trapper. We are also indebted to Arthur H. Howell and Dr. H. H. T. Jackson of the Bureau of Biological Survey and Dr. W. H. Osgood of the Field Museum of Natural History for the identification of certain specimens of mammals; to Dr. F. C. Bishopp of the Bureau of Entomology and Dr. E. W. Price of the Bureau of Animal Industry who have identified the parasites collected; and to Dr. W. C. Allee of the University of Chicago and Dr. H. K. Gloyd, Director of the Chicago Academy of Sciences, for helpful suggestions during the preparation of the manuscript. The map of the Great Smoky Mountain National Park is reproduced by courtesy of the National Park Service.

DESCRIPTION OF REGION

The Great Smoky Mountains National Park, some 428,000 acres, extends along the Tennessee-North Carolina boundary line for about sixty-five miles and includes within its area some of the finest virgin timber to be found in eastern United States. In this region the culmination of the Appalachian System is reached; it is characterized by rugged mountains, a rainfall approaching one hundred inches, luxuriant vegetation, and a rich fauna. Many of the peaks rise to a height of more than six thousand feet with summits approximately a mile above their bases but there is no definite timber line. The elevation of Clingman's Dome, the highest peak within the Park, is 6642 feet. The higher peaks are frequently enveloped in fog or low hanging clouds—a condition which contributes to the production of a humid environment and which, together with the ever-prevailing blue haze, accounts for the name given this range of mountains.

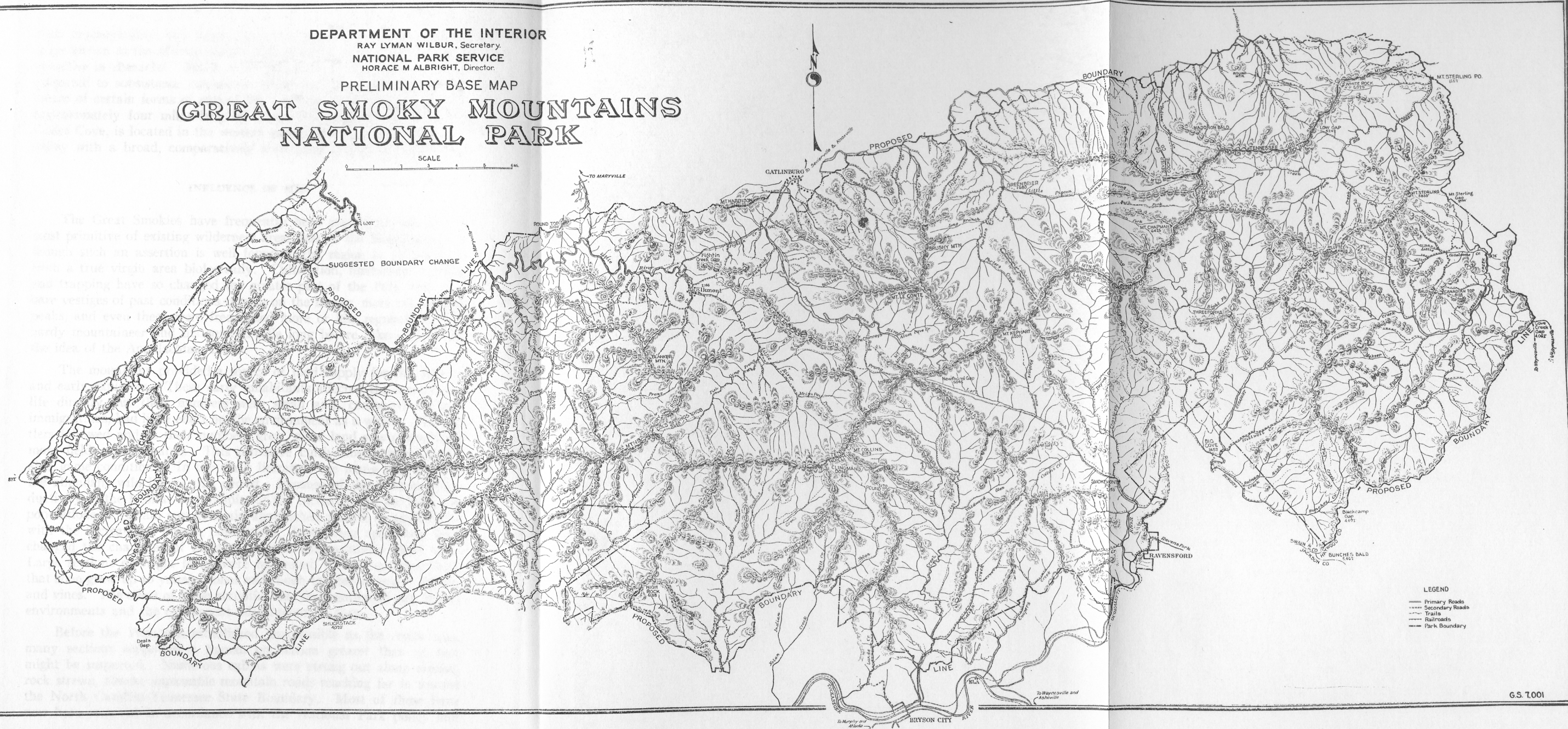
A large part of the Park Area was cut over many years ago and is now replaced by second growth of considerable size. Because of

DEPARTMENT OF THE INTERIOR
RAY LYMAN WILBUR, Secretary
NATIONAL PARK SERVICE
HORACE M ALBRIGHT, Director

PRELIMINARY BASE MAP

GREAT SMOKY MOUNTAINS NATIONAL PARK

SCALE
0 1 2 3 4 5 6 7 8 9 10
MILES



LEGEND
— Primary Roads
--- Secondary Roads
... Trails
--- Railroads
--- Park Boundary

their inaccessibility, two large areas, one about Mt. Guyot and the other known as the Morton Butler tract at Cades Cove, have remained primitive in character. Much of the land at lower elevations has been subjected to subsistence cultivation which favored, somewhat, the increase of certain forms of animal life. A large, well-cultivated valley, approximately four miles long by about two miles wide, known as Cades Cove, is located in the western end of the Park and is the only valley with a broad, comparatively level floor within its boundaries.

INFLUENCE OF MAN

The Great Smokies have frequently been considered one of the most primitive of existing wilderness areas east of the Mississippi and, though such an assertion is well founded, the region is far removed from a true virgin area biologically. Cultivation, lumbering, hunting and trapping have so changed the greater part of the Park that only bare vestiges of past conditions remain on the higher, more inaccessible peaks, and even these were frequented more or less regularly by the hardy mountaineer and his squirrel rifle long before hikers conceived the idea of the Appalachian Trail.

The mountains provided a source of food supply for the Indians and early explorers. These early inhabitants affected the mammalian life directly but their numbers were small and, compared to later immigrations, had little effect on the environment as a whole. The settlers followed and as their numbers grew, more land was cleared and more fields were created. This primitive cultivation induced favorable game conditions. In the early literature are many references to the abundant wild life of this period. Because of the increased productivity of the habitat and in spite of the increased kill for food, the populations of certain species again approached a state of equilibrium with the increase of human population. Lumbering operations later changed the character of large areas in a comparatively short time. Large sections of virgin forest were harvested, leaving cut-over lands that soon grew up to young timber and rough tangles of briers, bushes, and vines. The effect of these activities was the creation of new faunal environments and the consequent adjustments to them.

Before the Park was established, inaccessible as the region was, many sections supported a human population greater than at first might be suspected. Numerous cabins were strung out along eroded, rock strewn, almost impassable mountain roads reaching far in toward the North Carolina-Tennessee State Boundary. Most of these have now been removed in accordance with the National Park policy and

due to the character and climate of the country where vegetative growth is rapid, evidence of human habitation in many places is no longer apparent. At one time the little mountain community known as Big Greenbrier Cove (fig. 1), located in one of the wildest sections of the Park, is said to have had a voting population of over 200 people and some 250 children attended school near the forks of the Little Pigeon River. It appears as Brier in the Century Atlas. As late as the spring of 1931 more than fifty families resided in this settlement. In spite of this human population the game animals, with the exception of deer, have persisted in numbers large enough to respond favorably to protection.

Indiscriminate burning of the wooded slopes each spring or fall was widespread and in lands adjacent to the Park it still is. Under certain atmospheric conditions severe, wind-driven fires unquestionably destroyed food, cover, and breeding sites of animals thus rendering the environment temporarily unproductive. In some instances through this agency, however, and through inefficient farming and grazing, the distribution of certain species of animals may have been extended. This is indicated by the presence of the lemming vole, *Synaptomys cooperi stonei*, taken in grassy openings at an elevation of 2900 feet along Little River. At this locality timber had been cut out and fire, farming, and grazing had retarded the process of reversion to forest, temporarily maintaining the plant succession at the bush-sapling level with open grassy patches, a habitat compatible with the environmental needs of this particular rodent.

HABITATS OF MAMMALS

Although a detailed study of the habitats of the Park Area was not attempted, the following brief discussion is included to give a general picture of the various habitat types.

Beech-maple Habitat. The climax forest association consists of beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and hemlock (*Tsuga canadensis*) and occupies extensive areas between elevations of about 3000 and 4000 feet. It is a humid habitat with large, dense stands of timber in which the yellow poplar reaches a diameter of six feet and over. There is much forest litter and rotted, damp, moss-covered logs are present in great numbers. An understory is made up of small saplings of the above mentioned trees with thickets of rhododendron distributed throughout in suitable moist places.

Beech Habitat. In a few areas beech occurs in solid though somewhat open stands with comparatively little underbrush. A stand of

considerable size with trees dwarfed and gnarled by wind is located along the divide near Siler's Bald.

Spruce-fir Habitat. This habitat is composed of virgin spruce (*Picea rubens*) and Frazer's fir (*Abies frazeri*) both of which reach a diameter of three to four feet and often occur as a dense, solid forest. It is found on many of the higher peaks, is subjected to frequent local rains and much of the time is enveloped in fog or low hanging clouds. A rocky substratum with little earth and humus supports a luxuriant, thick mat of moss which makes up the forest floor and which is exceedingly moist the year round.

Oak-chestnut Habitat. The oak-chestnut habitat is located at lower elevations and is composed largely of second growth black oak (*Quercus velutina*) and chestnut (*Castanea dentata*). There is an abundance of dead chestnut trees—their gray, bark-stripped bolls standing conspicuously among the oaks and maples of the lower ridges—bearing evidence of the effect of the chestnut blight in this area. A few stands are still holding their own on some of the higher ridges and other restricted areas. A tree measuring nine feet in diameter is located about three miles above Greenbrier in what is known as Porter's Flats. The passing of this extremely important food species no doubt affected many of the mammals of this region but mast in abundance is still supplied by the oaks, maples, and silver bells. Chestnut mast was fairly heavy during the fall of 1933 on the summits of Mt. Harrison and the Pinnacle.

Heath Bald Habitat (fig. 2). The heath bald habitat is apparently the least favorable to mammals. Such balds are locally known as "slicks" and are composed of a thick growth of mountain laurel (*Kalmia latifolia*) and greenbrier (*Smilax* sp.). Many of them are of considerable size extending for some distance along the tops and slopes of ridges varying in height from three to five thousand feet. The summits of Brushy Mountain and the Bullhead are prominent examples of this habitat. In late spring and early summer the "slicks" are a mass of laurel blossoms presenting one of the picturesque settings for which the Smokies are noted. The cloudland deer mouse (*Peromyscus maniculatus nubiterrae*) was the only mammal collected in extensive areas of solid laurel. Tracks and feces of wildcats were noted in trails cutting through the "slicks".

Grassy Bald Habitat (fig. 3). The treeless, grass covered mountain tops located in the western end of the park are locally known as "balds" and, though of considerable extent, are inhabited only by mammals characteristic of higher timbered altitudes. Where shrubs occurred

in isolated clumps surrounded by grass the cloudland deermouse (*P. m. nubiterrae*) and the red-backed mouse (*Clethrionomys gapperi carolinensis*) were taken, while in the crevices of rock outcrops on Thunderhead traps yielded the Smoky Mountain rock vole (*Microtus chrotorrhinus carolinensis*).

Rhododendron Habitat (fig. 4). Although thickets of rhododendron (*Rhododendron maximum* and *catawbiense*) are commonly found along streams, they often cover large areas at high altitudes along the tops of ridges where they grow to considerable size and luxuriance making travel very difficult. It is in such "roughs" that bear trails frequently aid the hiker.

Broomsedge Field Habitat. When cultivation is discontinued fields soon grow to a thick cover of broomsedge (*Andropogon* sp.) and form a habitat which supports a rich mammalian fauna, both in numbers and species. The exodus of people from the area resulting from land purchases for the creation of a National Park, left many fields untended and greatly increased the extent of this habitat (fig. 3). Within the Park, however, it is more or less temporary as reforestation is comparatively rapid and replacement of sedge fields by thickets of black locust (*Robinia pseudo-acacia*), sassafrass (*Sassafrass sassafrass*), and yellow poplar (*Liriodendron tulipifera*) is said to take place in about five years.

Fallow fields in various stages of reversion contained the same mammals. The results of trapping showed that mammals occurred in heavy, solid fields of broomsedge less frequently than in fields dotted with briar patches, rock piles, and openings created by grazing cattle. Rabbits, which were very abundant in open situations, were noticeably fewer in number in dense broomsedge. In preparing the soil for cultivation, rocks were thrown up into piles or rock fences, which furnished excellent protection from predators and were extensively utilized as retreats by these animals. During the winter months, red squirrels were also found living in rock piles located near black walnut trees (*Juglans nigra*). Wild grapes (*Vitis* sp.) grow abundantly along fence rows and in the fall of the year provide a food item of considerable importance to opossums and raccoons.

DISTRIBUTION OF MAMMALS

On the basis of their present distribution in this region and their affinities to species in other sections of North America, the mammals of the Great Smoky Mountains may be divided into three distinct series: (1) those with northern affinities; (2) those with southern

affinities; and (3) those of widespread distribution. In this classification we have included only those species of which we have sufficient knowledge to justify their allocation. The distribution of a species is in a more or less constant state of flux and is subjected to, and profoundly affected by, changes in environment. In the lower elevations where cultivated areas are more common, the instability of the distribution of mammals associated with such situations as recorded in this report should be emphasized. The region is unusually favorable to reforestation and the transition from field to forest is comparatively rapid. Consequently, field-inhabiting forms will eventually be eliminated from the Park Area in many sections.

Now that farming in the Park has been greatly restricted, an excellent opportunity exists for a study of the succession of the abandoned fields to determine the effect of the reversion from field to forest upon the population and distribution of certain mammals as well as wildlife in general. Such information is limited and data of this nature accumulated over a period of years would be of inestimable value in the management of this region.

Mammals with Northern Affinities. This element in the mammalian fauna may also be called the mountain-top fauna for it is composed of species found on the mountains from approximately 3000 feet elevation to the tops of the highest peaks. These mammals are generally races of northern species whose range of greatest abundance and development lies to the north of this region.

Clethrionomys gapperi carolinensis, Carolina Red-backed Mouse.
Microtus chrotorrhinus carolinensis, Smoky Mountain Rock Vole.
Napaeozapus insignis roanensis, Roan Mountain Jumping Mouse.
Peromyscus maniculatus nubiterrae, Cloudland Deermouse.
Sorex fumeus fumeus, Smoky Shrew.
Sorex cinereus cinereus, Masked Shrew.
Sciurus hudsonicus abieticola, Appalachian Red Squirrel.

Mammals with Southern Affinities. This faunal element corresponds to what may be called the lowland community, as the species of which it consists are found from the outlying valleys up to approximately 2700 feet in the mountains. It has affinities with southern mammalian species for most of these mammals are found generally distributed through the southern states.

Cryptotis parva parva, Little Short-tailed Shrew.
Reithrodontomys humilis merriami, Harvest Mouse.
Peromyscus nuttalli nuttalli, Golden Mouse.
Peromyscus leucopus (intermediate between *leucopus* and *noveboracensis*), Woodland Deermouse.

Sigmodon hispidus hispidus, Cotton Rat.

Oryzomys palustris palustris, Rice Rat.

Pitymys pinetorum scalopsoides, Mole Pine Mouse.

This community is changing rapidly for most of the above listed mammals live in the cut-over lands and sedge-grass fields which are rapidly being reforested. It seems probable that many of these species have entered the mountain region after occupation by man. As these habitats are growing up into forest the mammals are being driven downward and outward. Some species such as the cotton mouse, the cotton rat, the rice rat and the little short-tailed shrew, which are found most commonly in the sedge fields, are becoming less abundant at higher elevations as these fields are turning into stands of young timber. Cotton rats were collected in 1931 and 1932 at Greenbrier at an elevation of about 1700 feet but since then have not been found that far back in the mountains. At that time they were found in two grassy areas. One of these is now reforested with young poplars and the other is a pasture closely cropped by cattle. Like the rice rat, of which only one specimen was taken, they were pioneer members of their species. They have probably been driven outward with the change in environment now that once cleared areas are in the process of reforestation.

Mammals of Widespread Distribution. The mammals which make up this series are species found from the lowest valleys in the Park, as well as those outside of the mountains, to the top of the highest peaks and are also found distributed over the eastern part of the United States both north and south of the Smoky Mountain range.

Blarina brevicauda talpoides, Large Short-tailed Shrew.

Marmota monax monax, Eastern Marmot.

Tamias striatus striatus, Eastern Chipmunk.

Procyon lotor, Eastern Raccoon.

Vulpes fulva, Eastern Red Fox.

Euarctos americanus, Eastern Black Bear.

Lynx rufus rufus, Eastern Bobcat.

Sylvilagus floridanus mallurus, Eastern Cottontail.

Synaptomys cooperi stonei, Stone's Lemming Vole.

ANNOTATED LIST OF SPECIES*

Didelphis virginiana virginiana Kerr. Virginia Opossum.

Ten specimens from Greenbrier, one from Three Forks.

The Virginia opossum, the most abundant fur-bearer, ranges throughout the greater part of the mountains though in diminishing numbers at higher elevations. It was found in and around old fields and in open woods along streams and often became a nuisance in trapping the larger mammals. According to local residents it was also very common in the past. Feces showed that a large part of the diet of the opossum in late summer and fall consists of blackberries (*Rubus allegheniensis*), poke berries (*Phytolacca decandra*), wild grapes (*Vitis* sp.) and persimmons (*Diospyros virginiana*). That their carrion-eating habit was quite pronounced was indicated by the increased effectiveness of traps after the bait became decomposed. One was taken in a trap baited with fish.

Breeding habits. A female collected on March 18 had 13 naked young about 24 mm. long in her pouch. Another taken on February 23 contained 8 embryos.

Parasites. Opossums were found infested with larval ticks (*Ixodes* sp.) and white round worms (*Physaloptera turgida*) were taken from the stomachs of the majority of specimens examined.

Measurements. Three males: total length (738-832) 781.6, tail (300-320) 311.6, hind foot (60-74) 69; five females: total length (671-725) 701.6, tail (285-310) 298.6, hind foot (59-66) 62.

Parascalopus breweri (Bachman). Hairy-tailed Mole.

One adult female was taken along Chapman Prong (3200 ft.). It was trapped under a damp, mossy rock in a rhododendron thicket along a small stream. An immature female was collected on Buck Fork in a similar situation. Tunnels of this species were seen in soft soil covered with hemlock needles on the divide near Mt. Kephart (5200 ft.). These appear to be the first recorded specimens from Tennessee.

Measurements. One adult female: total length 151, tail 33, hind foot 18.

Scalopus aquaticus aquaticus (Linnaeus). Eastern Mole.

One specimen from Dry Valley, Blount County, Tennessee, just outside the Park boundary. Tunnels of this species were seen in the lower coves below 1500 feet elevation around fields where the soil was somewhat sandy.

* All measurements and weights are given in millimeters and grams respectively, extremes enclosed in parenthesis followed by averages.

***Sorex longirostris longirostris* Bachman. Bachman Shrew.**

The humid nature of the Great Smokies and records of specimens collected in southwestern North Carolina and northern Georgia suggested the probable occurrence of the rare Bachman shrew in the Park Area but individuals of this species were not secured. We are therefore grateful to Mr. Willis King, Assistant Wildlife Technician of the Park for permission to include the following records:

"The present record is from Greenbrier, Tennessee, in Great Smoky Mountains National Park. Mr. Raymond J. Fleetwood, formerly Resident Wildlife Technician, found a male shrew of the species dead in a posthole, June 5, 1934. The posthole was in a field bearing a stand of sedge grass (*Andropogon*) at approximately 1600 feet elevation. The specimen was sent to the U. S. National Museum for identification and was added to the collection as USNM No. 258854.

"This species of shrew was found again February 4, 1936, in the same vicinity in one of the buildings of a CCC Camp. Dr. M. S. Crowder caught one in a mouse trap baited with cheese. The specimen was identified as *Sorex longirostris longirostris* by Mr. Arthur Stupka, Park Naturalist, and is now in the Park's study collection of vertebrate animals at Great Smoky Mountains National Park, Gatlinburg, Tennessee.

"The records of Bachman shrew in eastern Tennessee establish this species as occurring more than 100 miles north, and west, of the nearest record stations for the costal states and extends its known range in the southeast towards that in Illinois and southern Indiana."

***Sorex cinereus cinereus* Kerr. Masked Shrew.**

Ten specimens: Smokemont, Clingman's Dome, Mt. Kephart, Buck Fork, Mt. Collins, Dry Sluice, Mt. Guyot.

This shrew was taken in the same habitat with the smoky shrew.

Measurements. Four males: total length (89-114) 101.7, tail (40-47) 43.2, hind foot (7-13) 11.2; five females: total length (98-110) 101.6, tail (45-50) 47.4, hind foot (8-13) 11.2. Weights of two females 4.05 and 4.27 grams.

***Sorex fumeus fumeus* Miller. Smoky Shrew.**

Twenty-five specimens: Eagle Rock Creek, Clingman's Dome, Mt. Kephart, Chapman Prong, Dry Sluice, Little River (alt. 2900).

The smoky shrew was taken around or under damp, moss-covered rocks and fallen, rotted logs in both deciduous and evergreen forest, at elevations ranging from 2900 feet to the top of the highest peaks (fig. 6). Specimens collected in February, March, April and October were in the gray winter pelage.

Breeding Habits. A large female taken on October 12 at an altitude of 6200 feet was nursing. Two males taken on August 5 and 25 had greatly enlarged testes.

Measurements. Nine males: total length (113-125) 119.6, tail (42-50) 46.6, hind foot (12-15) 13.6; eleven females: total length (108-129) 116.9, tail (38-66) 49.7, hind foot (11-15) 13.9. *Weights.* Four specimens (5.50-10.55) 7.77. The female weighing 10.55 grams was nursing.

***Cryptotis parva* (Say).** Little Short-tailed Shrew.

Thirty specimens: Greenbrier, Fighting Creek near Gatlinburg, Fish Camp Prong.

This little shrew was found in fallow fields at lower elevations. Specimens collected near Gatlinburg and at Greenbrier (Laurel Creek) were found in moderately over-grown broomsedge fields. Several individuals were trapped at the bases of pines and small apple trees. At Fish Camp Prong they were taken in the runways of Stone's lemming voles (*Synaptomys cooperi stonei*) which were located in an open grassy patch along the forest margin at an elevation of 2730 feet. This is the highest elevation at which this species was recorded. Shrews were frequently taken in traps baited with the bodies of mice. They were active day and night.

Breeding Habits. A female taken near Gatlinburg on October 16 was found to be through nursing. Four males collected on October 20 had enlarged testes.

Measurements. Ten males: total length (69-76) 74.3, tail (16-21) 18.4, hind foot (10-11) 10.2; six females: total length (70-84) 74, tail (15-20) 18, hind foot (10-10) 10. *Weights.* Six males: (3.28-5.48) 4.13 grams; eight females: (3.50-5.72) 4.45 grams.

***Blarina brevicauda talpoides* (Gapper).** Eastern Short-tailed Shrew.

Sixty-nine specimens: Smokemont, Greenbrier, Mt. Kephart, Walker Prong, Horseshoe Mountain, Grassy Patch, Siler's Bald, Clingman's Dome, Fish Camp Prong.

The eastern short-tailed shrew was very abundant and was probably the most widely distributed mammal in this region occupying all types of habitat at all elevations. Its distribution is apparently unaffected by elevation for specimens were taken in the lowlands adjacent to the Park as well as on the higher peaks. The stomachs of two specimens contained the remains of a lepidopterous larva and a slug respectively. Occasionally these shrews were found dead in the trails but upon examination no indication of injury was noted. In one specimen a small spiral worm was found between the skin and flesh of the

shoulder.

Measurements. Ten males: total length (105-116) 112.6, tail (21-28) 25, hind foot (12-16) 14.9; Ten females: total length (105-129) 115.2, tail (21-31) 26.4, hind foot (13-16) 15. *Weights.* Five males: (13.61-18.0) 16.13 grams; five females: (15.32-20.5) 17.93 grams.

Myotis lucifugus lucifugus (LeConte). Little Brown Bat.

Two specimens were brought to us by a mountain boy who caught them in a cabin in Greenbrier.

Lasionycteris noctivagans (LeConte). Silver-haired Bat.

Three specimens. Two were shot at dusk in Cades Cove on April 21. The other was found injured at Greenbrier on March 18.

Measurements. Two males: total length (92-98) 95, tail (35-42) 38.5, hind foot (11-11) 11; one female: total length 97, tail 39, hind foot 11.

Pipistrellus subflavus subflavus (F. Cuvier). Georgian Bat.

One specimen was collected by Ennis Ownby in the loft of a grist mill in Greenbrier.

Eptesicus fuscus fuscus (Beauvois). Big Brown Bat.

One was taken in the loft of a grist mill, November 1, 1932.

Lasiurus borealis borealis (Müller). Northern Red Bat.

Five specimens were shot at dusk at Cades Cove and Greenbrier.

Corynorhinus macrotis (LeConte). LeConte Lump-nosed Bat.

One was taken in the attic of an abandoned schoolhouse near Gatlinburg. Another was found clinging to the chimney above the hearth in our cabin in Greenbrier.

Measurements. Two males: total length (96-101) 98.5, tail 44, hind foot 10. *Weights.* One male, 7.15 grams.

Euarctos americanus americanus (Pallas). American Black Bear.

One female and a large male taken above Greenbrier and a male taken along Ramsey Prong. Black bears are common in the Park Area and appear to be on the increase. While individuals are infrequently seen, evidence of their activity in many areas is quite conspicuous.

The survival in the Park of a sizeable stock of bear, sufficient to yield a favorable increase with protection, may be attributed in large measure to the existence of more or less extensive rugged sections at higher elevations. These areas provide the necessary cover for protec-

tion and rearing of young, an important factor if a species is to persist. Trapping and hunting for consumption, sport or pelts were pursued by local people and to a certain extent by residents of nearby settlements and towns. That this periodical cropping merely equaled or remained slightly below the annual increment of the restricted range is attested by the occurrence of these animals in considerable numbers when the Park was first established.

It is sometimes desired to venture comparisons of past with present numbers to indicate the trend of the population, but when such comparisons are based on the frequency of occurrence of feces, fresh tracks, etc., the following point should receive attention in the case of bear in the Park. The bear in this region were restricted to the rugged regions by hunting, trapping, molestation by unrestrained hounds and possibly the mere presence of small scattered cultivated fields with attendant people. At the present time almost all of these factors have been removed and the bears are ranging more widely, increasing their field of activity to the lower more accessible areas. Consequently, bear sign is more frequently encountered. The recently built horse and foot trails throughout the Park now permit easy access to the heavy timbered and rough areas thus also increasing the possibility of seeing bear sign. While there is perhaps no doubt that these animals have increased (1934) since they first received Park protection the added numbers probably have not been as great as the more common occurrence of sign might indicate.

The food of the black bear in this region is variable and changes with the seasons. In spring after they leave their dens they feed on the tender leaves of plants and deciduous mast which has laid through the winter. In summer blackberries form part of their diet while in autumn examination of feces indicated they were feeding on acorns, chestnuts, wild grapes, persimmons, poke berries, and apples. The stomach of one of the specimens secured was distended with the remains of acorns. Throughout the year when opportunity exists, bears dig out and eat ground-hogs and other mammals which they are able to capture. Local hunters report that they eat carrion. A favorite bait with bear hunters of the region is the "barbecued" carcass of a ground-hog.

Procyon lotor varius Nelson and Goldman. Raccoon.

Five specimens from Greenbrier. Raccoons were found throughout the mountains at all elevations but they are probably more common along the streams at lower altitudes. In their search for aquatic food in spring, they frequently turn over small rocks in shallow streams. Evidence of this activity is especially noticeable and easily detected where moss covered rocks have been disarranged exposing the bare

under-surfaces in marked contrast to the surroundings. During the fall of 1932 a number of raccoons made nightly raids on a wild grape thicket along the right fork of the Little Pigeon River in Greenbrier. Several were reported seen during the day. The specimens secured were parasitized by ticks (*Ixodes* sp.) and fleas. From an examination of stomachs and feces, their food consisted of wild grapes, pokeberries, and salamanders and other aquatic animals.

Measurements. One male: total length 784, tail 244, hind foot 107.

Mustela noveboracensis notia (Bangs.) Southern Weasel.

Four specimens from Lower Ramsey Branch and Pinnacle; one from Knoxville, Tennessee. Weasels are generally distributed throughout the mountains at all elevations though probably not so common in the dense evergreen forests. These are provisionally included under this subspecies but are probably intermediate with the northern race.

Measurements. Three males: total length (373-383) 377, tail (110-126) 118, hind foot (40-47) 44.3.

Mustela vison mink (Peale and Beauvois). Common Mink.

No specimens secured. A mink was caught in Greenbrier by Elbert Whaley and kept for us but had decomposed and had been thrown away before we arrived. Another was seen by Mr. Ownby and E. V. Komarek in the spring of 1933. Information secured from Mr. Whaley suggests that the mink apparently frequents lower, more open situations in winter and retreats into the deeper forest to rear its young in spring and summer.

Spilogale putorius (Linnaeus). Alleghenian Spotted Skunk.

A single individual was taken along a stream in cut-over woods. This species is said to be less common than the Florida skunk.

Mephitis elongata (Bangs). Florida Skunk.

Five specimens from Greenbrier and the Pinnacle. This skunk is generally distributed throughout the mountains but is probably more common about open fields and cut-over woodlands at lower elevations. Individuals of this species were heavily infested with ticks (*Ixodes* sp.), lice (*Neotrichodectes*) and tapeworms (*Oocharistica* sp., probably *mephitis*).

Measurements. Three males: total length (579-634) 598.6, tail (203-237) 215, hind foot (64-69) 66.5.

Vulpes fulva (Desmarest). Eastern Red Fox.

A red fox was found dead by Ennis Ownby along Dudley Creek where it probably fell exhausted after being run by hounds. Another

was seen in the early morning at Hall's Gap in North Carolina not far from Spence Field.

In 1932 we were informed that a number of foxes had been liberated in areas adjacent to the Park but the desired details could not be obtained. In answer to a request for information on this matter, Willis King, Assistant Wildlife Technician, National Park Service, kindly investigated further and secured the following notes from the Blount County, Tennessee, Fox Hunters Association. In a communication of October 5, 1936, Mr. King writes: "Mr. W. T. Griffiths and Homer Willicks, officials in the Association, advised me that about 150 red foxes were liberated in Chilhowee Mountain from near Sevierville to the Tennessee River, during the years from 1924 to 1926. Points of liberation mentioned were Callahan, Montvale, Townsend, Walland, Allegheny and Chilhowee. The animals were shipped from Waterloo, Minnesota. According to their description, the animals are distinguishable from the native red fox in that they appear somewhat larger, are more yellowish and have more white on the face and tip of the tail. The legs were described as being less dark than those of the native animals. From this description it would appear that the introduced form may be the species *Vulpes regalis*".

Urocyon cinereoargenteus cinereoargenteus (Schreber). Eastern Gray Fox.

No specimens taken. It is said to be less common than the Red Fox.

Lynx rufus rufus (Schreber). Wildcat.

Three specimens from Greenbrier.

The wildcat is generally distributed throughout the mountains at all elevations. Feces and tracks were frequently seen near Mt. Guyot, Brushy Mountain and along the Appalachian Trail from Newfound Gap to Clingman's Dome. On several occasions fresh tracks were noted in the road in front of the hotel in Greenbrier. Feces deposited in piles at intervals, a characteristic habit of the wildcat, were found along the crest of the Pinnacle. Judging from the size and state of disintegration of the remains in these accumulations, the top of this mountain had been the regular haunt of several cats. Specimens were heavily infested with fleas.

Measurements. One female: total length 760, tail 145, hind foot 152.

Marmota monax monax (Linnaeus). Southern Woodchuck.

Four specimens, three from Greenbrier, one from Three Forks. The ground-hog or "whistle-pig" of the mountaineer is common in many of the rocky slopes in deciduous forests as well as in fields and

cut-over lands throughout the mountains. The marmot occasionally does considerable damage to small cornfields. One field visited in July, 1932, was badly damaged and about two acres of corn were literally mowed down. The stalks were cut off about twelve inches from their bases, thus dropping the ears of corn to the ground where they were eaten. A half grown individual taken in August, 1932, was feeding on clover.

Measurements. Two females: total length (614-630) 622, tail (92-148) 120, hind foot (90-98) 94.

***Tamias striatus striatus* (Linnaeus).** Eastern Chipmunk.

Twenty-one specimens from Greenbrier, Eagle Rocks Creek, Porter's Flats, Mt. Harrison, Horseshoe Mountain, and Thunderhead.

The eastern chipmunk is common throughout the mountains, especially in open deciduous woods. They are found at all elevations though less abundant in the dense evergreen forests on such peaks as Mt. Guyot. They were frequently seen feeding on acorns (*Quercus* sp.), chestnuts (*Castanea dentata*), the mast of silver bell (*Halesia carolina*), beech (*Fagus* sp.), and other trees. Where such food is abundant they apparently form colonies. Since these squirrels were observed in every month of the year they apparently do not hibernate for any great length of time. They were not seen during cold periods but made their appearance if the weather became warm for a few days.

Measurements. Thirteen males: total length (238-278) 233.3, tail (70-92) 81, hind foot (30-40) 33.3; five females: total length (208-244) 225.2, tail (72-85) 80.4, hind foot (33-36) 34.6. *Weights.* Three males: (78-105.5) 98.6 grams; one female 79.5 grams.

***Sciurus hudsonicus abieticola* Howell.** Alleghenian Red Squirrel.

Forty-five specimens: Greenbrier, Horseshoe Mountain, Buck Fork, Newfound Gap, Ramsey Prong, Mt. Collins, Smokemont, Porter's Flats, Dry Sluice, Mt. Kephart, and Mt. Guyot.

Red squirrels are commonly known in this region as "boomers". During the summer months their shrill chatter is a characteristic note in the woods at higher elevations. They were found very abundantly and range throughout the mountains in both deciduous and evergreen forests. While they probably spend the greater part of the year at more elevated regions, in winter they are frequently seen in the lower settlements feeding on black walnuts in the course of which their faces become stained with the dark juices in the hulls of these nuts. In the winter also they were seen feeding on acorns, chestnuts, beechnuts, and the mast of silver bell, maple and buckeye trees, the buds of which

form a considerable part of their diet in the spring. During the summer they were often observed at higher altitudes eating blackberries and spruce cones.

In 1932 red squirrels were not seen about our cabin in the settlement of Greenbrier until in the fall when two were found raiding our supply of walnuts stored under the porch. They stayed with us for several months but disappeared in the spring although an abundance of walnuts remained. A half grown specimen was taken on October 9. Assistant Chief Ranger Dunn reported seeing two melanistic red squirrels at Cosby in 1934. Fleas, mites and lice were taken on these squirrels.

Measurements. Seventeen males: total length (293-340) 312.4, tail (117-150) 133, hind foot (43-51) 47.8; fifteen females: total length (295-329) 322.5, tail (116-169) 130.8, hind foot (46-50) 48.

Sciurus carolinensis carolinensis Gmelin. Southern Gray Squirrel.

Sixteen specimens: Russell Field, Greenbrier, Horseshoe Mountain, Fighting Creek, and Ramsey Prong.

Southern gray squirrels were more common at lower elevations though at high altitudes they were frequently seen in the hardwoods along the divide at Russell Field. Unlike red squirrels, they were seldom if ever found in the coniferous forest. They were associated almost exclusively with deciduous woods and field margins where during the autumn and winter they fed upon acorns, chestnuts, beechnuts, and the mast of buckeye and silver bell trees. In the spring they were observed feeding on the buds of a variety of bushes and hardwood trees. This species was not as common as the preceding. However, where the mast was heavy it occasionally was found in considerable numbers.

Local residents frequently referred to the incompatibility of the "boomer" and gray squirrel and on one occasion the reactions of these two species upon meeting was observed. While collecting on a wooded slope near Greenbrier one winter morning we saw a gray squirrel run into a hole about twenty feet from the ground in a silver bell tree which was still heavy with mast. Shortly afterward a red squirrel, without apparent knowledge of the presence of the gray, made its way up the same tree. When it reached the hole it hesitated. Immediately the gray squirrel jumped out and dashed down the tree with the chattering "boomer" in close pursuit. The chase continued for several hundred feet.

A nursing female was taken on March 11. Two males with enlarged testes and two half-grown individuals were collected in October. Specimens taken throughout the year were heavily infested with fleas.

Measurements. Six males: total length (441-463) 453, tail (200-

250) 213, hind foot (65-69) 67; five females: total length (428-477) 452, tail (185-234) 213.8, hind foot (62-68) 65.

Sciurus niger subsp. Fox Squirrel.

Information from reliable sources indicates that fox squirrels are common in certain localities adjacent to the Park. Although no specimens were secured within the Park Area, residents assert that these squirrels were locally common in the area some years ago. Under protection they may be expected to drift in again.

Glaucomys volans saturatus Howell. Southeastern Flying Squirrel.

Five specimens: Greenbrier, Smokemont, Knoxville.

Three specimens from Knoxville were taken in bird boxes by H. P. Ijams in deciduous woods surrounding a small artificial lake or pond. The other two specimens were taken in a mixed forest in the Park Area at elevations of 2500 and 3000 feet respectively.

Measurements. Average for two females: total length (232-250) 241, tail (93-109) 101, hind foot (31-31) 31. One male: total length 228, tail 103, hind foot 31. *Weights.* One male 65 grams; one female 97.59 grams.

Reithrodontomys humulis merriami (Allen). Merriam Harvest Mouse.

The harvest mouse was found locally distributed in a few isolated places. Seven specimens from Sevier County were secured, six of which were taken in small cleared areas under apple trees in a moderately overgrown broomsedge field. The seventh was trapped at the entrance to a small hole under a rock in a similar field along Laurel Branch in Greenbrier. Little short-tailed shrews were taken in the same vicinity. The highest elevation at which specimens were obtained was 1500 feet. A female taken on October 18 had enlarged mammary glands. One stomach examined contained unidentified seeds.

Measurements. Three males: total length (113-122) 116, tail (52-57) 54, hind foot (14-15) 14.6; three females: total length (113-134) 120, tail (50-64) 55, hind foot (14-15) 14.6. *Weights.* One female: 12.4 grams.

Peromyscus maniculatus nubiterrae (Rhoads). Cloudland White-footed Mouse.

More than one hundred specimens: Greenbrier, Chapman Prong, Brushy Mountain, Buck Fork, Eagle Rocks Creek, Grassy Patch, Thunderhead, Walker Prong, Mt. Guyot, Siler's Bald, Russell Field, Clingman's Dome, Ramsey Prong, Mt. Kephart, Mt. Collins.

This species inhabits the colder more humid situations at high altitudes (fig. 6). It was the most abundant mammal taken along the divide where it occupies the spruce-fir forest as well as the more or less open woods and margins of the grassy balds. At lower elevations where deep, shaded ravines, and heavy forested areas with dense crowns which tend to produce a cooler environment, are found, these mice range as low as 2500 feet.

Two females taken on March 31 contained three and four embryos respectively. The embryos of the latter were ten millimeters in length. Another collected on February 21 had four well developed embryos and two taken on August 24 had three and four embryos respectively.

Tapeworm cysts of a species not determined, and nematodes (*Longistriata* and *Oxyuris* sp.) were found in the intestines and cecae of some of the specimens collected.

Measurements. Ten males: total length (161-206) 181.6, tail (86-114) 95.6, hind foot (19-22) 20.6; ten females: total length (163-203) 184.2, tail (80-111) 94, hind foot (19-22) 20.8. *Weights.* Fifteen males: (15-65—21.8) 17.8 grams; nine females: (15.8—21.15) 20.03 grams.

Peromyscus leucopus leucopus (Rafinesque). Southern White-footed Mouse.

Thirteen specimens; Greenbrier, Porter's Flats, Fish Camp Prong.

Mammalogists who have had occasion to work with *Peromyscus* have no doubt been confronted with the perplexing problem of assigning names to individuals from areas of intergradation. Such is the situation in the Smoky Mountain region where the range of *Peromyscus leucopus noveboracensis* blends into the northward distribution of the typical and more southern subspecies *Peromyscus leucopus leucopus*. A comparative study of specimens from northern and southern localities would be necessary to determine definitely the relationships of specimens from this area. However, certain characters seem to indicate a closer affinity to the typical form and our specimens accordingly are listed here as *Peromyscus leucopus leucopus*.

This species inhabits the open woodland and field margins at lower elevations but where cultivation has extended back into the mountains it probably ranges up to about 2500 feet. The vertical ranges of this mouse and *Peromyscus m. nubiterrae* come together at an elevation of approximately three thousand feet.

Measurements. Ten males: total length (144-194) 161.1, tail (64-80) 71.1, hind foot (20-22) 21; one female: total length 160, tail 67, hind foot 21. *Weights.* Three males: (22.3-24.6) 23.28 grams.

Peromyscus gossypinus megacephalus (Rroads). Rhoads
Cotton Mouse.

Twelve specimens from Greenbrier and Fighting Creek near Gatlinburg.

These mice, the largest of the *Peromyscus* group occurring in the Park, were frequently collected in the open woodlands and field margins at low elevations where farming activity has produced brush growth and open forest situations. They probably range up to 2000 feet or higher. In several restricted areas they were found with *Peromyscus leucopus* but data sufficient to determine habitat preferences were not obtained. Two females taken on March 4 contained three embryos each. A male collected on October 15 had enlarged testes. Roundworms were found in the stomachs of several specimens.

Measurements. Ten males: total length (160-204) 180.3, tail (65-97) 75.3, hind foot (21-26) 23.7; five females: total length (161-196) 178.4, tail (63-90) 78.4, hind foot (20-24) 21.4. *Weights.* Three males: (30.25-36.24) 33.44 grams; two females (32.91-39.34) 36.12 grams.

Peromyscus nuttalli nuttalli (Harlan). Northern Golden Mouse.

Thirteen specimens: Greenbrier, Porter's Flats, Fighting Creek.

This species was taken occasionally along the edge of broomsedge fields, brier patches and old fences. It was found up to about 2500 feet elevation. A female collected on October 12 appeared to be through nursing.

Measurements. Seven males: total length (167-193) 177.8, tail (74-93) 86, hind foot (19-20) 19.9; four females: total length (155-182) 170.5, tail (72-89) 82, hind foot (19-20) 19.2. *Weights.* Two males: (20.88-22.56) 21.7 grams; one female: 25.45 grams.

Oryzomys palustris palustris (Harlan). Swamp Rice Rat.

The occurrence of this species in the mountain region is based on one specimen, an immature female, that was found dead on the sill of an old barn situated near a marshy creek in Greenbrier, at an altitude of about 2200 feet. This specimen was obtained on April 3, 1931, and although considerable trapping was done in that vicinity during 1931 and the following year no more were taken. This record is unique in that there seem to be no records of this species occurring above 1000 feet. Its distribution was apparently extended into the mountains as a result of agricultural activities of local residents.

Sigmodon hispidus hispidus Say and Ord. Eastern Cotton Rat.

Six specimens from Greenbrier.

In the mountains cotton rats were found only in one locality; a

heavily overgrown broomsedge field at an elevation of about 1700 feet near Greenbrier. They had well defined runways throughout the field. This species is common near Knoxville. Its distribution was also apparently extended into the mountains as a result of agricultural activities.

Measurements. Three males: total length (207-252) 230.6, tail (92-108) 99.6, hind foot (29-32) 30.6; three females: total length (197-208) 203.6, tail (87-93) 89, hind foot (26-30) 27.6.

Synaptomys cooperi stonei Rhoads. Stone Lemming Mouse.

Twenty-six specimens: Greenbrier, Siler's Bald, Roaring Fork, Spence Field, Buck Prong, and Little River (2900 ft.).

Lemming mice were found in small scattered grassy patches throughout the mountains up to the highest peaks. Generally, they had well defined runways in which grass cuttings were found. Several stomachs examined contained finely chewed grass. A female taken on March 17 contained three embryos about half developed; another taken on March 19 had one embryo near birth; two collected on March 12 and 23 had well developed embryos numbering four and one respectively. These mice were comparatively free of external parasites.

Measurements. Four males: total length (122-136) 127.7, tail (22-27) 24.5, hind foot (20-21) 20.2; five females: total length (120-133) 126.8, tail (20-27) 23.4, hind foot (19-21) 20.6. *Weights.* Three males: (31.2-35.6) 32.37 grams; two females: (32.85-36.) 34.4 grams.

Clethrionomys carolinensis Merriam. Carolina Red-backed Mouse.

Thirty-seven specimens: Mt. Guyot, Clingman's Dome, Spence Field, Buck Fork (4200 ft.), Mt. Collins, Mt. Kephart, Chapman Prong.

These mice are well distributed throughout the mountains at elevations above approximately 3000 feet. In the humid forest they were taken most often among mossy rocks but near Spence Field they were also found on top of the grassy balds. On the latter they were trapped at the bases of isolated shrubs situated in the open grass. In the thick mat of moss which at high altitudes is abundant in the forest their runways were common (fig. 6). During the summer these mice were occasionally seen on the trails at midday. Several stomachs examined contained finely chewed green vegetable material.

A female taken on July 31 contained three embryos about 16.8 mm. in length. Another taken on July 21 contained three embryos about 13 mm. in length and one very small one in the left horn of the uterus. Half-grown individuals were collected on July 31 and August 23.

Warbles (*Cuterebra* sp.) were commonly found in mice of this species, most frequently in males and then nearly always near the testes. In a male freshly caught on July 31 three large warbles were found by the testes alongside of which was a cavity formed by the emergence of one of these larvae and which upon examination was found to contain small, live maggots. In this specimen the right testis was only about half the size of the left.

Measurements. Ten males: total length (138-163) 146, tail (39-53) 45.8, hind foot (19-21) 20; ten females: total length (135-152) 145.4, tail (30-55) 43.6, hind foot (19-21) 20. *Weights.* Six males: (20-29.6) 22.8 grams; four females: (26.6-31.28) 28 grams.

Microtus chrotorrhinus carolinensis Komarek. Smoky Mountain Rock Vole.

Thirty-seven specimens: Mt. Kephart, Chapman Prong, Buck Fork, Newfound Gap, Eagle Rocks Creek, Siler's bald, Smokemont, Sawtooth, Thunderhead.

The Smoky Mountain rock vole is generally distributed throughout the higher regions in the mountains and is most common among the mossy rocks and logs in the high humid forest (fig. 6). On the grassy balds of Thunderhead several were trapped in rock outcrops on the grassy summit. The vertical distribution of this form corresponds with that of the red-backed mouse (*Clethrionomys carolinensis carolinensis*) with which it shares the same habitat. A female with three embryos near birth was taken on March 13. Males taken between July 31 and August 27 had enlarged testes. Two half-grown individuals were collected on October 9. A female trapped along Eagle Rocks Creek was decidedly silver-gray in color on the upperparts and grayish-white underneath. The stomach of one taken in September contained blackberry seeds. There is some indication that the abundance of this rodent varies from year to year.

About 65 per cent of the specimens obtained were infested with warbles (*Cuterebra* sp.). Usually from one to three were found around the testes and the underside of the hind legs. One had several ticks (*Ixodes* sp.) attached about its nose. Mites (*Laelaps microti* and *Neoschongastia signator*) were collected from this species and nematodes (*Cheiropteranema* sp.) were found in their intestines and cecae. One individual taken on September 14 had scars and sores on the stomach wall which appeared to be due to a nematode infection.

Measurements. Ten males: total length (144-177) 163.6, tail (46-55) 49.7, hind foot (20-24) 21.9; nine females: total length (147-175) 172, tail (43-56) 50.9, hind foot (20-22) 21. *Weights.* Four males: (26-46.7) 33.7 grams; one female: 28.4 grams.

Pitymys pinetorum scalopsoides (Audubon and Bachman). Mole Pine Mouse.

Thirteen specimens from Cades Cove and Greenbrier.

The pine mouse in certain areas occurred in considerable numbers but was not generally common and its distribution appears to be localized. In Cades Cove they were taken in an open deciduous woods where they had runways under a mat of dead leaves. They were also observed foraging about during the daytime in this locality. In Greenbrier they were collected in tunnels in an apple orchard and in a small marshy area at the edge of a woods. Pieces of grass, decomposed apples, and kernels of corn were found in the runways. A female taken on March 16 had three well developed embryos; another taken on March 24 had two.

Measurements. One male: total length 124, tail 27, hind foot 16; four females: total length (124-126) 124.7, tail (23-28) 26, hind foot (16-18) 17.

Ondatra zibethica zibethica (Linnaeus). Common Muskrat.

A single specimen was collected along the Little Pigeon River about two miles below Greenbrier. At this particular locality muskrats were foraging in a nearby cane patch where they had done considerable damage. They were also feeding on young willow shoots (*Salix* sp.) along the river and would frequently cut off a small bush.

Measurements. One male: total length 596, tail 293, hind foot 80.

Mus musculus musculus Linnaeus. House Mouse.

Three specimens from Greenbrier.

Though most frequently taken around cabins and barns, this introduced species is sometimes found at some distance from human habitations. It is very common in this region.

Measurements. Two males: total length (144-145) 144.5, tail (71-78) 74.5, hind foot (16-19) 17.5.

Rattus norvegicus (Erxleben). Norway Rat.

One specimen from Greenbrier, one from Eagle Rocks Creek.

The Norway rat is found abundantly around buildings and occasionally in rock fences bordering corn fields. The specimen taken along Eagle Rocks Creek was at an elevation of about 3800 feet about five miles from the nearest habitation.

Measurements. One male: total length 314, tail 168, hind foot 39.

Rattus rattus rattus (Linnaeus). Black Rat.

Three specimens from Greenbrier.

This rat was found abundantly around barns in the vicinity of

Greenbrier. White-spotted phases were reported but none were secured.

Measurements. One female: total length 372, tail 174, hind foot 35.

Napaeozapus insignis roanensis (Preble). Roan Mountain
Jumping Mouse.

Seven specimens from Eagle Rocks Creek.

The distribution of the jumping mouse is apparently somewhat localized and the species is probably more abundant than the number of specimens secured might indicate. Six of the seven individuals obtained were taken in the humid forest along Eagle Rocks Creek at an elevation of 4000 feet. One was seen at mid-day along the Buck Fork at an altitude of about 3000 feet. These are believed to be the first specimens recorded from Tennessee.

Measurements. Three males: total length (224-246) 232, tail (145-151) 148, hind foot (29-32) 30; two females: total length (217-231) 224, tail (138-145) 141.5, hind foot (30-30) 30.

Sylvilagus floridanus mallurus (Thomas). Eastern Cottontail.

Fourteen specimens from Greenbrier.

The eastern cottontail was found abundant in open woods and broomsedge fields. In the course of a short walk as many as a dozen were counted as they foraged about at twilight. According to local reports rabbits were noticeably less common in Greenbrier several years ago when foxes were more numerous. In 1933 residents asserted that the latter were again invading the region about this settlement which may be due to the increased food supply. During the fall of the same year several rabbits were reported found dead but none were examined. The year previous two specimens were sent to the University of Tennessee where post-mortem examinations were performed to determine if tularemia was present. The results were positive.

During extended cold spells rabbits frequently hole-up in rock piles for several days while in summer such retreats are utilized to avoid the heat of mid-day. In such situations several specimens were caught by hand. This species was found infested with ticks (*Haemophysalis leporis-palustris*), fleas, and bot fly larvae (*Cuterebra* sp.).

Sylvilagus transitionalis (Bangs). New England Cottontail.

This species has been taken in the mountains of North Carolina north of the Park and also to the south in Georgia. Local people asserted that two kinds of rabbits are found in the park and that one of these which inhabits the higher regions is called the "woods rabbit". Although *transitionalis* was not taken by us it is probable that further investigations will establish its presence in this area.

Odocoileus virginianus virginianus (Boddaert). Virginia Deer.

According to local residents, deer were once common in some sections of the area now included in the Park but due to over-hunting and possibly disease they now occur infrequently. Several individuals have been seen and tracks have been found near Cades Cove and Cosby and until the past few years, when hunting has been prohibited, several were taken annually in the Butler Tract near Gregory Bald. Eb Whaley who has spent the greater part of his life in the vicinity of Greenbrier states that as far back as he can remember deer were rare. He recalls that as a boy a buck was shot along the stream now called the Buck Fork. We have received information from a number of individuals referring to disease among deer and it is possible that this factor may have played an important part in their disappearance.

BIBLIOGRAPHY

- BREWSTER, WILLIAM
1886. An ornithological reconnaissance in western North Carolina. *Auk*, 3: 94-112.
- BRIMLEY, C. S.
1905. A descriptive catalogue of the mammals of North Carolina, exclusive of the Cetacea. *Jour. Elisha Mitchell Sci. Soc.* 21: 1-32.
- BRIMLEY, C. S. and FRANKLIN SHERMAN, JR.
1908. Notes on the life-zones in North Carolina. *Jour. Elisha Mitchell Sci. Soc.* 24: 14-22.
- COPE, EDWARD DRINKER
1870. Observations on the fauna of the southern Alleghanies. *Amer. Nat.* 4: 392-402.
- GOLDMAN, EDWARD A.
1918. The rice rats of North America (Genus *Oryzomys*). *North Amer. Fauna* 43: 21-24.
- HOWELL, A. BRAZIER
1927. Revision of the American lemming mice (Genus *Synaptomys*). *North. Amer. Fauna* 50: 12-16.
- HOWELL, ARTHUR H.
1918. Revision of the American flying squirrels. *North Amer. Fauna* 44: 19-26.
- JACKSON, HARTLEY H. T.
1928. A taxonomic review of the American long-tailed shrews (Genera *Sorex* and *Microsorex*). *North Amer. Fauna* 51: 40.

KOMAREK, E. V.

1932. Distribution of *Microtus chrotorrhinus* with description of a new subspecies. Jour. Mamm. 13: 155-158.

MILLER, GERRIT S., JR.

1924. List of North American recent mammals, 1923. U. S. Nat. Mus. Bull., 128, 673 p.

NELSON, E. W.

1909. The rabbits of North America. North Amer. Fauna 29: 166-169, 195-199.

NELSON, E. W. and E. A. GOLDMAN

1930. Six new raccoons of the *Procyon lotor* group. Jour. Mamm. 11: 453-459.

OSGOOD, WILFRED H.

1909. Revision of the mice of the American genus *Peromyscus*. North Amer. Fauna 28: 47-48, 113-121.

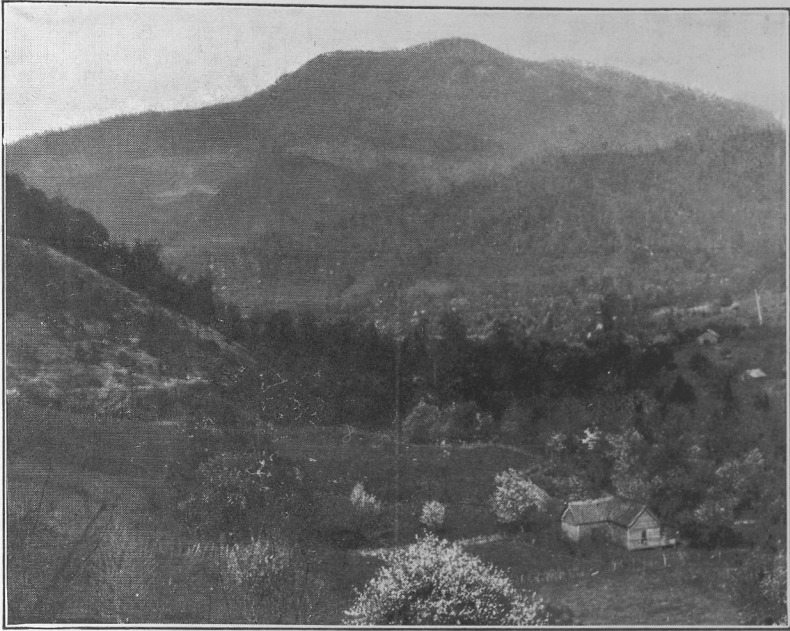


Fig. 1. View of Greenbrier Cove in the spring of 1931. The mountain in the background is the Greenbrier Pinnacle.

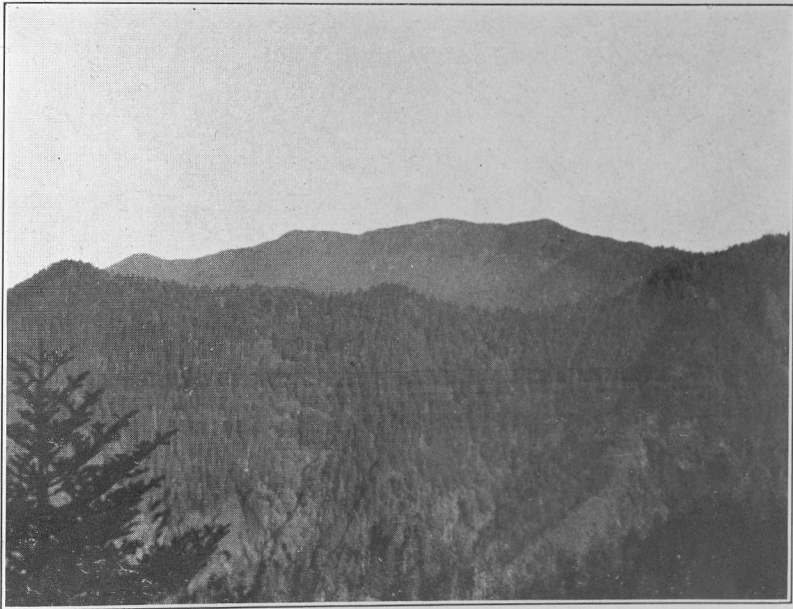


Fig. 2. Mt. Le Conte from the Appalachian Trail near Newfound Gap. The light area in the lower right is a ridge covered with mountain laurel. Such ridges are locally called "slicks".

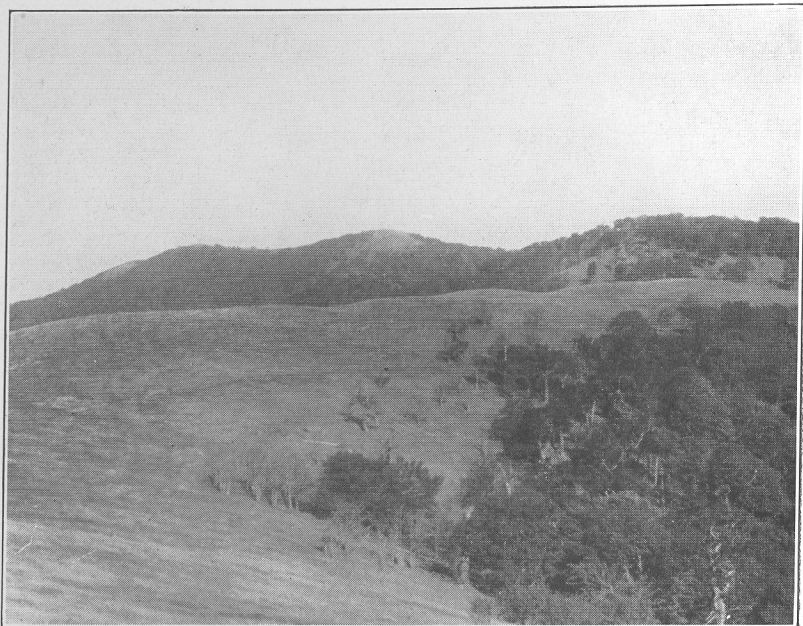


Fig. 3. A grassy "bald" near Thunderhead Mt.—September, 1934.



Fig. 4. Trail along the Buck Fork in the summer of 1931. The dense vegetation bordering the trail is chiefly rhododendron (*Rhododendron* sp.).



Fig. 5. Cornfield one year after cultivation was discontinued. Blight-killed chestnut trees are visible above shrub foliage.



Fig. 6. Habitat study at 4500 feet elevation in which *Peromyscus maniculatus nubiterrae*, *Clethrionomys carolinensis*, *Microtus chrotorrhinus carolinensis*, and *Sorex fumeus* were frequently taken.